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Bacterial Colonisation of Doppler Probes on Vascular Surgical Wards

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Aim: *hospital acquired infections cost the NHS £1 billion each year and medical equipment may act both as source and vector of nosocomial infection. This study examined bacterial contamination of Doppler ultrasound probes (USP) in routine use on vascular surgical wards in six hospitals and the knowledge of staff about the potential for cross infection from contaminated probes.*
Methods: *probe head impressions and swab cultures of probe holders were plated on mannitol salt agar before and after cleaning with a paper towel. Putative* S. aureus *isolates were identified to species level and susceptibility to selected antimicrobials tested. Concurrently, junior medical staff were surveyed about probe cleaning protocols.*
Results: *methicillin susceptible* S. aureus *was isolated from 2/21 (10%) with near confluent bacterial growth from six others (28%). The latter may have obscured low numbers of* S. aureus. *Further since swabs were plated without prior enrichment culture, it is likely that contamination with* S. aureus *might have been underestimated. No positive cultures were obtained after wiping the USP with a paper towel. 22/23 (95%) junior doctors failed to clean the USP prior to use.*
Conclusion: *USP contamination with pathogenic bacteria occurs under "in-use" conditions and junior medical staff are unaware of simple measures to prevent this. Strict guidelines for USP cleaning between patient use should, therefore, be adopted particularly when monitoring postoperative graft patency.*

Key Words: Ultra sound probes; vascular wound infection.

Introduction

Hand-held ultrasound probes are widely used on surgical and medical wards and in outpatients' clinics with individual instruments often being used in several different locations within the hospital. In vascular surgical wards they are often used to monitor infrainguinal graft patency during the early postoperative period. In these patients postoperative wound infection may be associated with serious morbidity and mortality and may occur in 15–18% of patients.[1,2] One mechanism through which wound infection may occur is by contact of the wound with contaminated medical devices.

A recent report by the National Audit Office stated that "Hospital acquired infections are a huge problem for the NHS. They prolong patients' stay in hospital and, in the worst cases, cause permanent disability and even death. By implementing the NAO recommendations the NHS could make real improvements in the quality of care for patients and could free up significant additional resources for patient care." The report also suggested that nosocomial infection cost the NHS £1 billion each year.[3]

In this study the hypothesis tested was that ultrasound probes (USP) under "in-use" conditions could be contaminated by bacteria and could be easily cleaned using a simple technique. Thus, microbiological sampling of these devices were performed before and after cleaning them with paper towel. No attempt was made to correlate the findings of this work with the prevalence of wound infection in patients who were resident within the six hospitals at the time of the study. User awareness of the potential danger posed by USP contamination to vascular surgical patients and protocols for their cleaning were examined.

Materials and Methods

Vascular and general surgical wards in six hospitals (two teaching and four district general) were examined with the prior permission of the consultant medical staff but without prior warning to the ward staff. Twenty-one USPs (Super Dopplex, Huntleigh Diagnostics, Cardiff, U.K.) were examined.

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Table 1. Microbiological findings.

	No culture	Positive culture	MSSA	Mixed growth
Probe head	17	4*	1*	3*
Probe holder	17	4*	1*	3*
Storage bags	21	0	0	0

* Different instruments.

For the probe heads, impressions were taken on mannitol salt agar plates. The heads were then thoroughly wiped with a dry paper towel and second impressions of the heads were obtained.

For the probe holders (where the probe slots into the side of the instrument during storage) a swab was taken from the surface, as obtaining impressions was not possible. After taking the first swab, the holders were cleaned with a paper towel and swabbing was repeated. Swabs were also taken from inside the bags in which the instruments were stored.

All microbiological studies were performed at one site. The mannitol salt agar plates were incubated for 48 h in air at 37 °C. Putative isolates of *S. aureus* were subcultured on blood agar for purity and then identified using standard techniques. Susceptibility to selected antimicrobials was determined using a modified Stoke's disc-diffusion method. During the visits to the study hospitals 23 junior doctors (House Officer: 13; Senior House Officer: eight; Specialist Registrar: one) were interviewed and asked whether the probe heads were cleaned regularly before use in vascular surgical patients and about the type of cleansing agent used. All medical personnel surveyed were members of vascular teams who used USPs on a regular basis.

Results

On gross inspection all USP were dirty and although one probe head was cracked it was still used regularly. Eight of the 21 instruments (39%) produced positive cultures of which two grew methicillin sensitive *Staphylococcus aureus* (MSSA) (Table 1). Of these one MSSA culture was obtained from a probe head and the other from a probe holder. These two MSSA cultures were obtained from separate instruments. The remaining six cultures yielded a near confluent mixed bacterial growth from three probe heads and three probe holders, again from different instruments. No positive cultures were obtained from the probe heads after wiping them with a paper towel and none from the second swab from the probe holders. Swabs taken from the container bags in which the instruments were stored did not grow any bacteria.

Of the 23 junior doctors who were questioned about their protocol for probe cleaning prior to use only one reported that he routinely cleaned the probe head prior to use, using an alcohol wipe.

Discussion

Medical equipment including reusable tourniquets,[4] endoscopes,[5,6] stethoscopes[7] and ventilators[8] can act as a reservoir for pathogenic organisms and thus it is imperative that reusable instruments are thoroughly cleaned between use. In the context of this study Ohara *et al.*[9] have demonstrated that during ultrasound procedures staphylococci from a patient's skin may be transferred to the ultrasound equipment and that *Staphylococcus aureus* can survive in the coupling gel despite it having bacteriostatic activity. A similar report by Muradali *et al.*[10] suggested that simple wiping of the probes with a dry towel can decontaminate them. However, Ohara[9] demonstrated very clearly that simple mechanical wiping of the probes was ineffective and a significant reduction of probe colonisation only occurred after wiping the probes twice with 70% ethanol impregnated paper.

Although only two (10%) of the probes tested in this study yielded *S. aureus* on culture, the fact that a significant nosocomial pathogen such as *S. aureus* was found on these devices gives cause for concern. Further, it should be noted that no enrichment techniques were used for culture and, thus, low-level contamination with this bacterium – particularly sublethally damaged cells – may not have been detected. Moreover, six (29%) probes yielded near-confluent growth following culture and this may have obscured low numbers of *S. aureus*.

We would therefore recommend that future studies of USP contamination employ enrichment cultures to recover low numbers of potentially pathogenic bacteria. In addition, serial dilution in liquid media from swabs of probe heads may circumvent the problem of identifying putative pathogens if very heavy contamination is encountered.

The Centres for Disease Control (CDC) divides medical devices and equipment into three categories (critical, semi-critical and non-critical) based on the risk of infection involved in their use.[11] Although USPs should be classified as non-critical or semi-critical equipment, they may become critical if they are contaminated with pathogens such as *S. aureus*. This is more likely if adequate protocols for probe cleansing are not in place and this latter problem is highlighted in the current study with only one of 23 junior hospital doctors routinely cleaning the probes with an alcohol wipe prior to use. Although it is not possible to state whether the USP contamination identified by our investigation resulted in the transmission of *S. aureus* between patients, it is reasonable to assume that the potential for this existed. Moreover, several hospitals that took part in this study do not routinely store *S. aureus* isolates from vascular wounds. Even if these isolates had been compared with the probe isolates using molecular epidemiological techniques, such as pulsed-gel electrophoresis, it would have been difficult to determine whether an infected patient had contaminated a probe, rather than vice versa. Accordingly, we would recommend that health care personnel who use these devices are aware of this risk and the simple measures by which it can be nullified.

Conclusion

USP contamination with pathogenic bacteria occurs under "in-use" conditions and the junior medical personnel are unaware of simple measures that prevent this. Protocols for the cleaning of USP between patient use should be introduced to reduce the risk of infection, particularly when monitoring graft patency during the early postoperative period.

Thus, we would recommend that each Doppler instrument is kept in a plastic container with a lid, that can easily be cleaned by the nursing staff each day. Further, the probe heads should be wiped twice with alcohol impregnated paper before use.

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